No doubt "the statistics so tabulated" give the results which the author has seen, for are not such statistics, after being inspected by the medical officers of the army, regularly forwarded to the Adjutant-General of the forces for his information? but what has this to do with boat-racing or running? These three exercises are as different in character and as different in their demands upon the physical energies of the human body in their practice, and in the results of their practice, as it is possible to conceive; and who that had investigated these three modes of muscular exertion would thus run them together for the purpose of showing their value or the results of their practice on the development of the chest? If the development of the chest is mainly due to the muscular exertions of the arms, how can running develop it, unless a man run upon "all fours?" When organising this "course of gymnastic instruction for recruits," we held ever before us a principle precisely the opposite to that which regulates either good running or rowing. In these, *sameness* of action, from the start till the close of the exercise, prevails; in the gymnastic course it is *variety*, the course embracing several hundreds of exercises, requiring different degrees of effort, executed at different rates of speed, employing every portion of the frame, and notably the upper limbs and trunk of the body—exercises all tested and proved to accomplish given results, on thousands of men, and over many years of careful observation, long before they were embodied by us in our military system. These three exercises should be estimated each by itself, and allowed to stand on its own feet. No real or permanent advantage can accrue to any of them by being thus lumped together, the more especially as they are in their nature so dissimilar.

ARCHIBALD MACLAREN

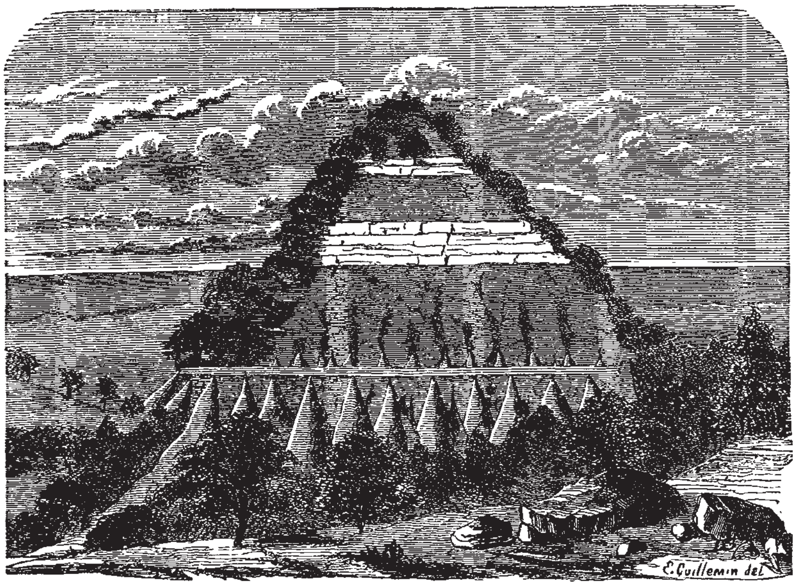
E. Guillemin del.

FIG. 1.—The Pyramid Mountain

THE EARTH

The Earth: a Descriptive History of the Phenomena of the Life of the Globe. 2 vols., with numerous maps and illustrations.

The Ocean, Atmosphere, and Life. Being the Second Series of a Descriptive History of the Phenomena of the Life of the Globe. 2 vols., with numerous maps and illustrations. By Elisée Reclus. Translated by the late B. B. Woodward, M.A., and edited by Henry Woodward, British Museum (Chapman and Hall 1871 and 1873.)

I.

IT is at length beginning to be acknowledged on all hands that no system of education can be pronounced perfect without a recognised position being assigned to the study of science. It cannot, of course, be supposed that in the ordinary *curriculum*, say of a university education, the various subjects of scientific study can obtain that exclusive attention which is required, in order to master them; but it is of the highest importance that, by the introduction and use of suitable text-books, the mind of the youthful and ardent lover of Nature in her various phases should be directed and prepared for entering upon those more minute studies and exhaustive researches in reference to particular subjects in the wide field of scientific inquiry, by which alone he can hope to force Nature to disclose her secrets.

Such a text-book we have in the work now before us—for these four volumes really form one entire work—a most admirable translation of a treatise on the earth and its phenomena by the eminent French *savant*, M. Elisée Reclus, the result of more than fifteen years' careful study, travel, and research. The translation is by the late Mr. B. B. Woodward, the Queen's librarian at Windsor Castle, and edited since his death by his brother, Mr. Henry Woodward, of the British Museum. Notwithstanding the editor's apology, the work suffers but little from its appearance in an English dress; in fact, the translation has been carried out with such remarkable success, that it possesses all the merits of an original English work. The constitution and phenomena of the planet in which we live are subjects of the deepest interest and importance to us all, and, to the earnest and thoughtful seeker after knowledge, present marvels on a scale of grandeur and magnitude far beyond the comprehension of the mere superficial observer. As M. Reclus says:—

"True enough that the earth is nothing but an almost impalpable grain of dust to the vision of the astronomer scanning the nebulæ in the field of his telescope, but it is, nevertheless, quite as much worthy of study as any other of the heavenly bodies. If it does not possess magnitude of dimensions, it presents an infinite variety in all its details. Whole generations, living one after the other upon its face, might pass their lives in studying its phenomena, without comprehending all their full beauty. There is not even any special science, having for its aim some portion of the terrestrial surface, or some particular series of its products, which does not present to our *savans* an inexhaustible field of inquiry."

The two first volumes of the work, to which alone we must at present confine our attention, consist of four main divisions—(1) on the earth as a planet, (2) on the land, (3) on the circulation of water, and (4) on subterranean forces. The first division treats of the form, structure, and motion of the earth, explaining with great lucidity the different theories respecting its formation.

M. Reclus then proceeds to give an outline of the geological history of the earth as exhibited by the stratification of rocks. In places where the strata have remained undisturbed by the action of the sleepless forces ever at work upon the earth's crust, it is possible to see the strata in their regular order of succession, giving, as it were, an abstract of the earth's geological history. Probably the most remarkable instance in point is to be found in the "Pyramid Mountain," the sketch of which is taken from the famous "Pacific Railroad Report."

The second division treats of the form and distribution of the continents, and points out the wonderful harmony and analogy which prevail in the configuration of continents and oceans, the arrangement and peculiarities of mountain ranges, the origin of valleys, ravines, gorges, and other depressions of the earth's surface. The question of the origin of mountains and valleys is still, generally speaking, an open one amongst geologists; but, nevertheless, with regard to valleys and ravines, one can in many cases distinctly perceive that their formation is due to the ceaseless action of water through countless ages, mountain torrents cutting their way even through vast mountain chains. Nothing can convey a more impressive idea of the tremendous power of water as a natural agent, than the wonderful cañons of Mexico, Texas, and the Rocky Mountains, where the torrent may be seen rushing along through the incision it has cut out for itself in the hard rock at a depth of several thousand feet between perpendicular walls. The greatest of these cañons, that of the Colorado, is 298 miles in length, and its sides rise perpendicularly to a height of 5,000 or 6,000 feet. Valleys at their commencement usually assume the form of amphitheatres in a degree more or less marked. The most regular in form are to be seen in the Central Pyrenees. "The most remarkable, on account of their vast dimensions and the snow-clad terraces which surround them, are the *oules* (boilers) of Garvarnie, Estaubé, and Troumouse, which the slow action of centuries has hollowed out in the calcareous sides of the mountains of Marboré. Undulating tracts of pasture-land furrowed by torrents, prodigious walls rising to 1,500 or even 2,000 or 3,000 feet in almost perpendicular height, gigantic steps on which whole nations might find room to sit, cascades which either spread out over the precipice and float away in a diaphanous veil of mist, or rush down into the valley like an avalanche; the high summits, glittering with unstained snow, which rear their heads high above the wall of cliffs, as if to look over the inclosure—all these features we find combined far in the recesses of these solitary mountains, so as to render the Pyrenean amphitheatre one of the grandest *tableaux* in Europe." In the third division, on the circulation of water, the author discusses at considerable length the phenomenon of snowfall on mountain heights, the successive stages through which the snow-field passes into the glacier form, the structure and phenomena of glaciers, subjects towards the elucidation of which Prof. Tyndall has made such valuable contributions. The cause of the intersection of crevasses in glaciers is fully explained. A marginal crevasse, as is well known, first appears in a direction tending up the stream of the glacier; it is then carried round by the current until it inclines in a down-stream direction, and is then intersected by another crevasse opening like the first in an up-stream direction. The process is repeated until the numerous intersecting crevasses form a complete labyrinth.

After several very interesting chapters upon the subject of springs in their different varieties, the remainder of this division is devoted to the discussion of lakes and rivers, and here we find the fact carefully explained and illustrated that the hydrographical systems in different parts of the world exhibit the same relative harmony and order as the forms of the continents. The chapters explaining the process of the formation of deltas, by what are aptly termed "working rivers" (*fleuves travailleurs*), are especially worthy of attention, and will be found to contain a collection of maps and diagrams in illustration of this branch of the subject.

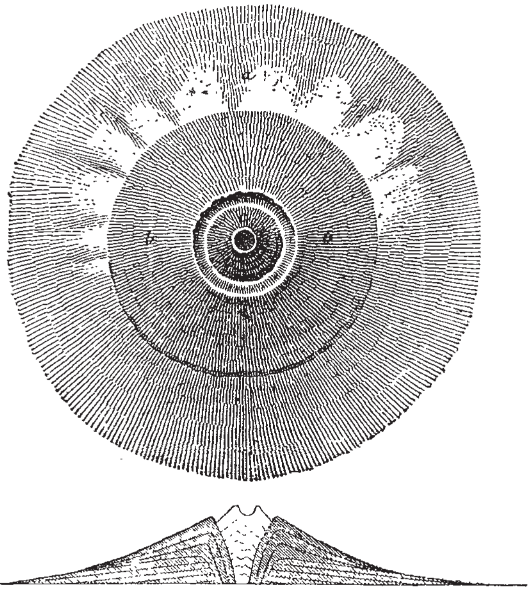

FIG. 2.—Plan and section of the volcano of Rangitoto.—*a* Declivities of tuff; *b* Cone of lava: *c* Pyramid of Scoriæ.

The last division, on subterranean forces, contains some of the most interesting chapters of the whole work, being devoted to the consideration of the most mysterious and appalling of terrestrial phenomena, namely, volcanic eruptions and earthquakes. Science has not yet succeeded in establishing any definite theory respecting the origin of volcanic eruptions, although most valuable contributions have been made to this branch of scientific study by Prof Palmieri, who so courageously stuck to his observatory on Mount Vesuvius throughout the whole of the tremendous eruption of 1872. The symmetrical form of the craters of many volcanoes is very remarkable, in some instances the outline of the cone and crater being absolutely perfect in its symmetry, as in the case of the volcano of Rangitoto, of which a plan and section here reproduced is given in the work.

Our space forbids our entering more fully at present into the merits of these interesting volumes. G. I. F. C.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

Dana on Corals

A Reply to the Criticism of Mr. Duncan

In a criticism of Prof. Dana's work on Corals and Coral Islands, printed in a recent number of Nature (vol. vii. p. 119), Mr. Duncan has seen fit to mention my name and certain of my views adopted by Dana in a somewhat discourteous manner. I therefore beg leave to reply, as briefly as possible, to some of his strictures, which are both erroneous and unjust.

Concerning the general character and plan of Dana's book it is not my intention to say anything, for those are matters which chiefly concern the author and publisher. It is to be presumed that they know, quite as well as any critic, the kind of book demanded by the public—at least by the American public—and experience every day shows the errors of critics in this respect. Certainly few authors have had more extensive and successful experience in writing strictly scientific books for the public than Prof. Dana.

Mr. Duncan criticises the introduction of brief notices and descriptions of "animals which are not corals, and which in no way affect or produce coral reefs or islands," evidently alluding to the Actiniæ, Hydroids, and Bryozoa; for he says, "all the notices and descriptions of the Actiniæ and Hydroidea might have been omitted, as they only confuse the subject." Surely Mr. Duncan ought to know, and if he does, should not ignore the fact, that Millepora, and the allied genera, are true Hydroids, and at the same time form large and abundant corals, which contribute very largely to the formation of coral reefs and islands both in the Atlantic and Pacific Oceans. Moreover, this important fact is stated by Dana on page 104 of his book, and its discovery is correctly attributed to Agassiz, while the animals are illustrated by a cut copied from his figures. It should be added that this discovery, made twenty five years ago, has recently been confirmed by Pourtales ("Deep Sea Corals," p. 56, 1871). That many of the ancient fossil corals were of the same nature scarcely admits of doubt, although the writer has elsewhere shown that this was not the case with all the so-called "Tubulata" Why, then, should this important class of corals be omitted from such a work? As for the Actiniæ, their relationship to the ordinary stony corals is so close, both in external appearance and internal anatomy, that no general work on corals could be considered at all complete without an account of them. Their physiology is also much better known than that of the coral animals. Moreover, they are the only near relatives of the true corals that the majority of the readers of the book will ever see alive.

The Bryozoa are also quite entitled to the page and a half allowed them in this book, for that they do contribute something to the existing coral-reefs can be easily demonstrated. One species of *escharella*, abundant on the eastern coast of the United States, forms solid coral-like masses often two or three inches in diameter, which accumulate in large quantities over wide areas, and, under favourable circumstances, would form limestones of considerable thickness. Some of the coral-reef species grow still larger and occur in profusion. In the Palæozoic coral-seas and reefs the Bryozoa were of still greater importance, and some of the so-called "true corals" of those times evidently belonged to this group in addition to those usually referred to it. The stony Algæ also, are by no means to be ignored in treating of coral reefs, and the half page devoted to them might well have been extended rather than omitted. Darwin, Agassiz, Major Hunt, and others besides Dana, have recognised their agency in furnishing calcareous matter to the reef limestones. Fine specimens of such limestones, composed almost entirely of their remains, may be seen in many American museums.

Mr. Duncan, in criticising Dana for adopting the classification which he believes most natural, makes this remark: "The introduction of American novelties to the exclusion of well-recognised European classifications, is neither right nor scientifically correct." Are we to infer from this that "American novelties" are less valuable than French or English ones, providing they be equally true to nature? Or does our critic prefer European error to American truth? Certainly no one has contributed more, in the way of original investigations and discoveries, to a true classification of the corals than Dana himself, in his great work on the Zoöphytes of the U.S. Exploring Expedition, which was far in advance of any work on this subject that had been written in Europe up to that time (1846). In some respects his classification was far more natural than that proposed afterwards by Edwards and Haime. Unfortunately at that period most of the corals and polyps in European museums had not been described or figured by European writers in a manner accurate enough to make their identification possible, or even, in many cases, to show their generic and family characters. That Edwards and Haime, having access to those collections, and having the benefit of Dana's great work, should have been able to make corrections and improvements was natural. Nor was it less natural that, after the publication of the more accurate descriptions and figures in their works, an American, having these and all the other works at hand, with constant access to the original types of Dana, to the unrivalled collections of corals brought together by Agassiz, and to all the other collections in the United States (by no means few or small) should, after devoting a large part of his time for twelve years to the special study of corals, have been able to make still other corrections and improvements, even in opposition to the views of certain European writers. But several European authors have also made numerous changes in the system of Edwards and Haime, and are likely to make many more. Certainly the time has not yet come when we can consider the classification of corals permanently fixed.

Whether the "novelties" to which he refers be "scientifically correct" is quite another question, and one that must be settled in the scientific way, by the evidence of facts observed, and not by denunciations, nor by dogmatic assertions. In selecting examples of the supposed inaccuracies of my views, as adopted by Dana, Mr. Duncan cites the "Oculina tribe," which the writer has established to include not only the Oculinidæ, but several other families, referred by Edwards and Haime to the Astræidæ and elsewhere. He says—"The admission of Orbicella, which is really the old Astræ of Lamarck (not of 1801), and of Caryophyllia into this well-differentiated tribe, is simply absurd, for they possess structural characters sufficiently diverse as to place them in different families." As a matter of fact, the writer has placed these same corals in different *families* in several papers published during the past five years, and this is the view adopted by Dana; so the argument quoted becomes "simply absurd." Again, he says that "Astrangia was well differentiated long before Prof. Verrill was heard of," and adds that Conrad Lonsdale and "the distinguished French Zoöphytologists consolidated the genus, which has nothing in common with the Oculinidæ." What he means by "consolidated" in this connection, it is difficult to tell, for all that Conrad and Lonsdale did was to describe very poorly, under the name of "Astræ," two or three fossil species, which Edwards and Haime afterwards referred doubtfully to Astrangia. The genus itself was first pointed out by Dana in 1846, and named Pleiadia, as stated in his book, page 68; but it was not at that time strictly defined, for there were no species in the collections of the Exploring Expedition; consequently the name Astrangia, proposed two years later, has been universally adopted. Dana's original specimens, with the MS. names placed upon them in 1845, still exist in our collections. But what my own age or reputation in the year 1848 has to do with the matter is not obvious. I trust that even then I was old enough to have seen the absurdities of such a criticism as that under discussion. That I have, since that time, carefully studied sixteen species of that genus and described a large number of new ones, while only three were known to Edwards and Haime, is true. That I have shown the close relationship between this genus and Cladocora and Oculina is equally true, and I presume that had Mr. Duncan enjoyed as good opportunities as I have had for studying this and all the related